Oct. 12, 1937. F. N. BECKER 2,095,587

FUEL FEEDING MECHANISM FOR GAS PRODUCERS

Filed May 7, 1934 2 Sheets-Sheet 1

FIG. 1.

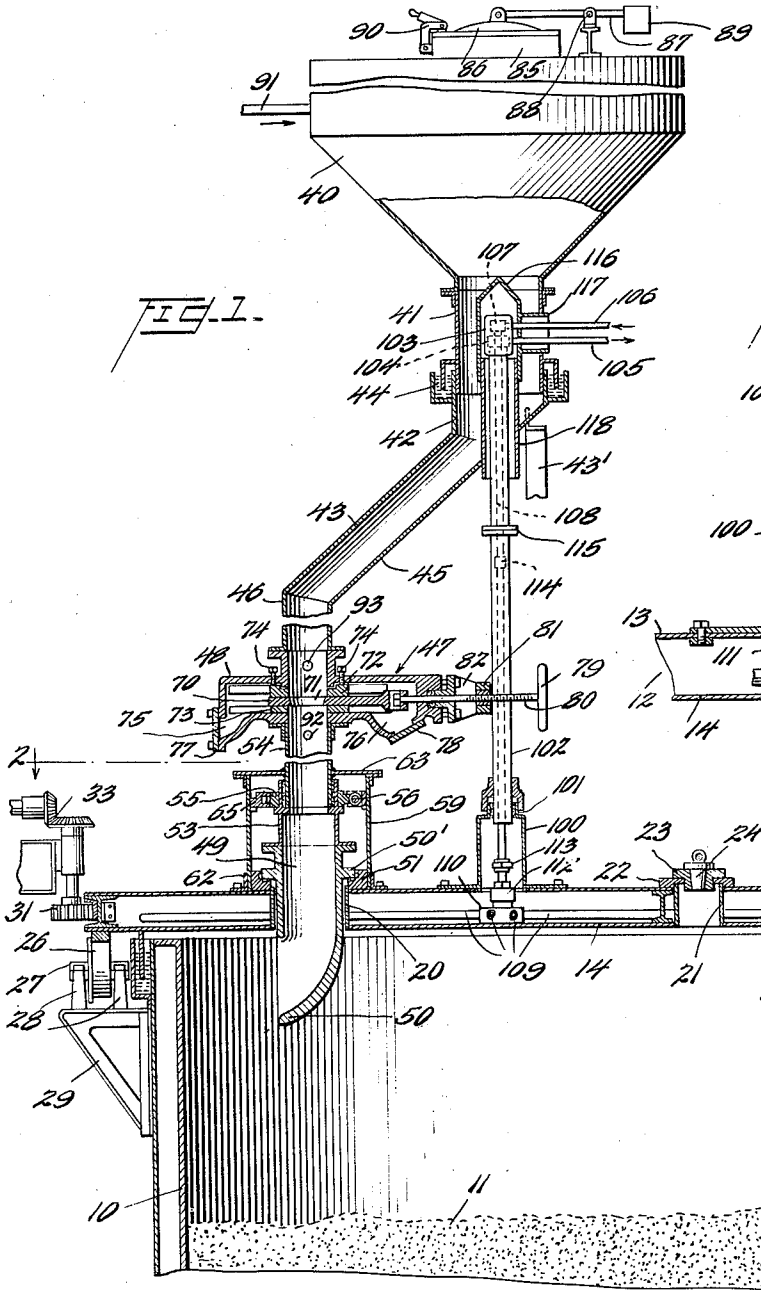

FIG. 3.

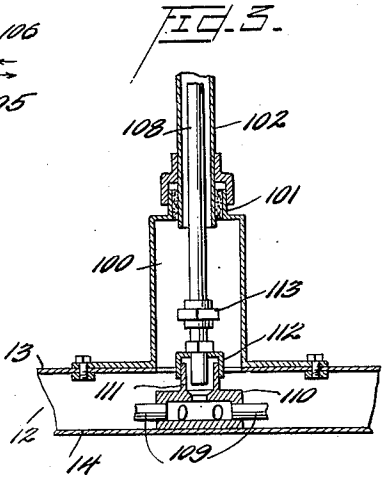

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FIG. 2.

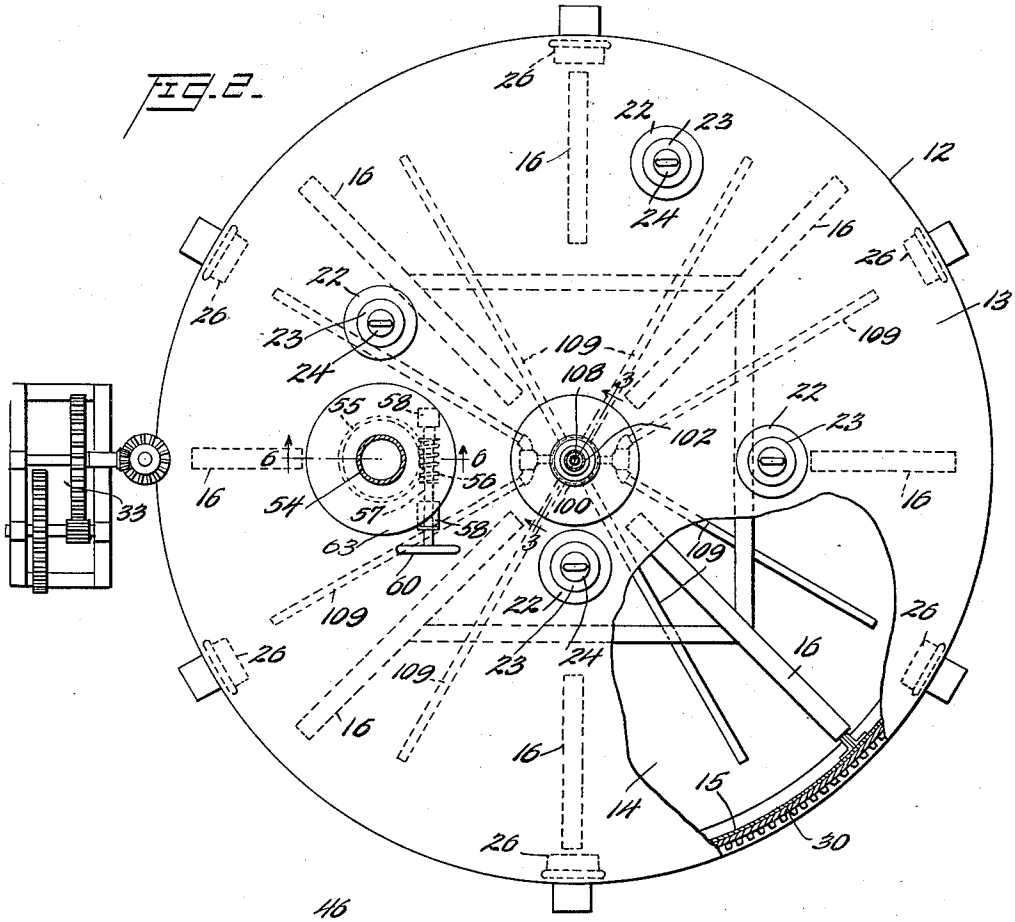


FIG. 4.

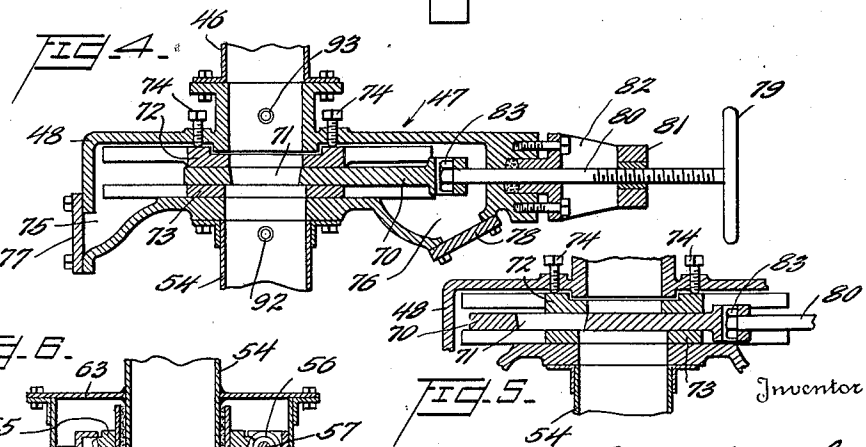
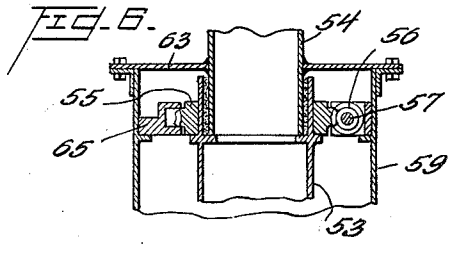


FIG. 5.

FIG. 6.



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FUEL FEEDING MECHANISM FOR GAS PRODUCERS

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Application May 7, 1934, Serial No. 724,415

2 Claims. (Cl. 48—86)

The present invention relates to a gas producer and particularly to the fuel feeding or charging mechanism thereof.

The ordinary gas producer is designed for continuous operation and comprises essentially a shell for enclosing a comparatively large body of fuel, a portion of which fuel is in a state of combustion, means for introducing fresh fuel at the top of the producer, and means at its bottom for the continuous or intermittent removal of the resulting ash. In the operation of the producer a gaseous current, generally air with a certain proportion of intermixed steam or water vapor, is passed upwardly through the producer shell under greater than atmospheric pressure. It is highly important that the velocity of this gaseous current be maintained as uniform as possible over the entire horizontal cross-sectional area of the producer as it is found that combustion occurs at a faster rate in one section of the producer if the velocity of the gas passing upwardly through that section is greater than the velocities of the gases passing upwardly through the remaining areas or sections of the fuel bed.

Due to variations in the character of the fuel, it is not possible to obtain at all times uniform velocity of upward flow of combustion supporting air over the entire horizontal cross-section of the producer, and where it appears that there is an excessive velocity of gas flow through any definite area of the fuel bed, it is customary for the operator to counteract this tendency by heaping larger quantities of fresh fuel upon that area of the upper surface of the fuel body than upon the remaining areas. In other words, in the operation of a producer it is frequently necessary to apply fresh fuel to one particular area of the fuel bed upper surface in order to insure that combustion shall proceed at a uniform rate over the entire horizontal cross-sectional area of the body of fuel within the producer. The present invention contemplates an improved fuel feeding mechanism whereby the operator may cause the fuel to be distributed either uniformly over the entire surface of the body of fuel in the producer or to be applied locally to any area which requires the addition of a substantial body of fuel to bring about balanced operation.

The fuel feeding means which comprises the subject matter of the present invention is designed particularly for use in connection with a gas producer having a revoluble top, which top is also provided with water cooling means. The charging aperture formed in the top is eccentrically positioned and hence describes a circular path about the axis of revolution of the producer top. The pipes for leading water to and from the producer top are disposed axially of the top, and these cooling pipes are so disposed and arranged with respect to the revolving fuel feeding chute or conduit that there is no interference between the pipes and conduit due to movement of the producer top. The fuel feeding conduit embodies a lower section which projects through the charging aperture in the producer top and is so formed and mounted that it may be manipulated by the operator to direct fresh fuel to any area of the surface of the fuel bed within the producer. The fuel feeding conduit likewise includes a novel control valve for regulating the flow of fuel through the conduit. Improved means is also provided for preventing the escape of producer gas to the atmosphere through the feed chute even when the upper end of this chute is open for the introduction of fresh fuel. The revolving top of the producer is formed in a novel manner, and the water cooling means provided possesses advantages not heretofore realized in other types of water-cooled producer tops.

By way of example, one form of the invention is illustrated in the accompanying drawings. It will be appreciated, however, that in adapting the invention to producers which vary in details of construction and which are intended for the consumption of fuel of varying characteristics, the design and arrangement of the component elements of the invention may be considerably varied without departure therefrom.

In the drawings:

Figure 1 is a vertical axial section through the upper portion of a gas producer having the novel revoluble top and water-cooling and fuel-feeding means, the fuel feeding conduit being broken away just above and below the valve, and the valve being illustrated in a position which makes an angle in a horizontal plane with its true position, in order that it might be shown in full longitudinal section;

Figure 2 is a section on line 2—2 of Figure 1, partly broken away;

Figure 3 is a section on line 3—3 of Figure 2;

Figure 4 is a longitudinal vertical section through the fuel valve;

Figure 5 is a similar view but showing the valve member in a different position from that in which it is shown in Figure 4; and

Figure 6 is an incomplete section on line 6—6 of Figure 2, on a somewhat larger scale.

The shell of the producer is indicated at 10 in

Figure 1. The exact design and construction of the shell are immaterial to the present invention, but preferably it is of the cylindrical water-cooled type, which is commonly used. The grate mechanism, blowers, etc., are not illustrated and may be conventional in construction although preferably of the type described and claimed in my patent application Serial No. 726,982, filed May 22, 1934.

The upper level of the body of fuel in the producer is indicated at 11, and the producer top is indicated generally at 12. The top comprises essentially two circular plates 13 and 14 of the same diameter and coaxially disposed about the central vertical axis of the producer shell, the lower plate 14 being somewhat heavier than the upper plate 13 and the plates being arranged in spaced parallel planes. The under surface of the circular marginal portion of the upper plate and the upper surface of the marginal portion of the lower plate are secured respectively to the top and bottom surfaces of the flanges of an annular beam 15, preferably H-shaped in cross-section, the ends of this beam being suitably secured together so that it comprises a sealing member for water introduced between the plates 13 and 14 for cooling purposes, as well as a structural supporting and tying member. A plurality of radially extending braces, preferably formed as beams of H-section, are indicated at 16, the outer ends of each of these beams being secured to the circular member 15 and their upper and lower surfaces to the top and lower plates 13 and 14 respectively, these radial members imparting strength and stiffness to the central portion of the top.

The top of the producer is apertured at a plurality of points, a relatively large aperture for fuel charging purposes being indicated at 20, and a cylindrical sleeve comprises the wall of the aperture, the upper end of the sleeve making water-tight connection with the upper plate, and the lower end of the sleeve making water-tight connection with the lower plate. Four smaller apertures, also defined by sleeves which pass through and are secured to the upper and lower plates, are provided, one of these being indicated at 21 in Figure 1. These apertures are known as viewing apertures or poke-holes and are disposed respectively at different radial distances from the axis of revolution of the top. Normally these last mentioned apertures are closed to prevent the escape of gas, each closure comprising essentially a fixed seat secured to the upper plate 13 of the top and indicated at 22, an annular removable plug 23 mounted upon seat 22, and a smaller removable plug 24 fitting in the central recess in annular plug 23. By removing plug 24, the operator uncovers a relatively small aperture through which he may view the upper surface of the fuel bed in the producer. Upon removal of both plugs 23 and 24, a larger aperture is presented through which a slice bar or poker may be inserted.

Secured to the lower surface of the lower plate 14 is an annular trackway 25, this trackway being also directly beneath the supporting annular frame member 15. Trackway 25 rests upon a plurality of rollers, of which there may be six or more, one of these rollers being indicated at 26, the axle 27 upon which the roller is mounted being supported upon pillow blocks 28 which are in turn mounted upon brackets 29 rigidly secured to the outer surface of the producer shell. An externally toothed ring 30 is fastened to the web of the annular frame member 15, and meshing with the teeth of this external ring are the teeth of a pinion 31 which comprises the driving pinion whereby the top and the fuel feeding mechanism, to be hereafter described, may be intermittently or continuously revolved and at the desired speed. I preferably drive the pinion 31 through reducing gearing, indicated generally at 33, from a variable speed electric motor, but other types of driving mechanisms may be provided if desired. A gas-offtake is indicated at 34 and a water sealing device at 35, this water seal comprising a downwardly extending annular plate 36, the upper edge of which is secured to bottom plate 14 of the producer top and an annular member 37 of angular cross-section which, in combination with the adjacent face of the outer surface of the producer shell, defines an annular trough adapted to contain a body of water into which the cylindrical plate 36 projects. The body of water within this trough is sufficiently deep to prevent the escape of gas between the top of the shell and the botttom of the producer top under normal operating pressures, while the seal permits free revolution of the top relatively to the shell.

The fuel feeding mechanism includes a hopper member 40 disposed above the producer top and a conduit or chute for leading fuel by gravity from the lower portion of this hopper to and through the eccentric fuel charging aperture 20 in the producer top. The hopper 40 is supported in any suitable manner by means not illustrated. It preferably has a conical bottom terminating at its lower end in a cylindrical discharge tube 41 which is coaxial with the producer top 12. The lower end of this discharge tube 41 is in concentric relationship with the upper end 42 of the feed chute, generally indicated at 43, and by means of which fuel is conducted from the hopper to the producer. The feed chute is revoluble with the producer top, and hence the upper section 42 of the chute revolves relatively to the discharge tube 41 of the hopper. To prevent leakage of gas between these relatively rotatable parts, they are caused to have close sliding fit with each other, and in addition the water sealing device indicated generally at 44 is provided. The chute 43 is suitably supported from the producer top, a portion of a bracing member provided for this purpose being indicated at 43'.

Just below the upper section 42 of chute 43 is the inclined section 45 which in turn opens into the lowermost vertically extending section 46 of the chute, this lowermost section being coaxial with the charging aperture 20 of the top. This lowermost section includes a control valve generally indicated at 47, the valve casing 48 being provided with a central aperture in alignment with the portions of the chute above and below the same, and also includes a revoluble lower end section, indicated at 49, having a deflecting member 50 by means of which coal falling vertically through the chute may be directed to one area or another of the surface of the fuel bed in the producer.

The revoluble section 49 and coal distributing member 50 are of heavier section than other portions of the chute so as to withstand the wear incident to the impact of coal falling through the chute and are shown to be supported upon a supporting and guiding ring 51 mounted upon the upper plate 13 of the producer top, a flange 50' of member 49 resting in a groove formed in this guide. To the upper end of member 49 is se-

cured the tubular extension 53 of lighter section, the upper end of which makes a sliding fit with tubular section 54 of the chute. Fixed upon the outer surface of tubular member 53 is a worm wheel 55, the teeth of which mesh with the teeth of a worm 56. A worm shaft 57 is supported in bearings 58 mounted in the wall of a cylindrical housing member 59, the shaft projecting externally of this housing and having mounted upon its end a hand wheel 60 by means of which it may be rotated and hence rotation of the coal distributing member 50 effected.

The lower edge of the cylindrical housing 59 is detachably connected, as by an annular angle member 62, to the upper plate 13 of the top, and the annular top plate 63 of the housing is secured to the section 54 of the chute, preferably by welding. This housing therefore constitutes a gas-tight enclosure for the revoluble coal distributing member and prevents the escape to the atmosphere of any gas which may pass the sliding joint between members 53 and 54. A guide ring 65 encircles the worm wheel 55 and is secured to the inner wall of cylindrical member 59 of the housing, this guide ring having surfaces which slidably engage portions of the worm wheel 55 just above and below the teeth thereof.

Referring now more particularly to the valve for controlling the flow of fuel through the feed chute. The valve member comprises a horizontally disposed and movable plate 70 having a port 71 with a frusto-conical wall as shown, the diameter of which at its lower end is less than the diameter of the feed chute. The plate moves between upper and lower valve seats, the upper seat being indicated at 72 and the lower seat at 73, both seats being annular, the lower seat resting upon the bottom plate of the casing and the upper seat resting upon the upper surface of the valve member. The upper seat 72 is adjustable and is normally held in close sliding engagement with the upper surface of the valve member by means of a series of adjusting screws 74. By means of these screws the proper adjustment of the upper seat with respect to the valve member may be maintained while at the same time it is always possible, by releasing the screws, to free the valve member should it become stuck or bound between the upper and lower seats because of the presence of dust or because of rusting of the surfaces due to the presence of moisture.

At the ends of the valve casing there are provided enlarged chambers, indicated at 75 and 76 respectively, which are adapted to receive dust carried laterally by the valve member in its movements. The dust collecting chamber 75 is provided with a removable plate 77, and chamber 76 likewise has a removable plate 78, it being possible to free these chambers of any collected dust by removal of the plates just mentioned. Movement of the valve member to control the downward gravity flow of fuel is brought about by manipulation of the hand wheel 79 which is rigidly mounted upon the end of the valve stem 80, stem 80 being threaded and passing through a threaded nut 81 fixed in extension 82 of the casing, the inner end of the stem 80 having an enlargement, or being provided with a nut 83, by means of which it is locked to the valve member but in such manner as to be freely revoluble relatively thereto.

The port 71 formed in the valve member is frusto-conical as shown. By reason of the fact that the diameter of the chute just below the valve member is somewhat greater than the diameter of the portion of the chute lying just above this member, complete closure of the conduit above the valve is effected prior to the time when the port is moved entirely out of communication with that portion of the conduit lying below the valve. This may be seen clearly from an inspection of Figure 5. Thus an aperture remains through which any particles of coal or coal dust may be discharged downwardly from the valve port after closure of the chute and will not be trapped between the upper and lower valve seats. Because of this a minimum amount of dust will be moved onto the lower valve seat when the valve is closed, and wear and interference will be reduced to a minimum. Naturally the port need not be frusto-conical to effect this desired end, but I prefer to so form it in order that the upper end of the port may closely approximate in area the area of the chute just above it in order that there may be no ledge or shoulder exposed to the falling fuel.

The hopper 40 is charged through an aperture formed in its top, which aperture is encircled by the annular upwardly projecting flange 85. A swinging cover for the charging aperture in the hopper is indicated at 86, such cover being pivotally suspended from one end of a lever 87 pivotally supported at 88 upon a bracket mounted upon the upper surface of the hopper top. The opposite end of lever 87 is provided with a counterweight 89 which approximately counterbalances the weight of the cover 86. Normally the cover is held in closed position by a manually operable latch 90 which holds it tightly against its seat, a gas-tight gasket of any suitable material being interposed between the cover and seat to decrease the likelihood of gas leakage. When a fresh charge of fuel is to be placed in the hopper, the latch 90 is released, the cover 86 swung to one side, the fuel introduced, and the cover replaced and relatched.

Prior to charging, it is desirable to clear the hopper and the associated fuel chute of its contained gas in order to prevent discharge of this gas into the surrounding atmosphere when the cover is removed. To effect this, steam is introduced into the hopper through the pipe 91, a sufficient quantity of steam being blown into the hopper to evacuate the gas and drive it back into the producer against the producer pressure. The valve member 70 may then be closed, and to maintain the lower section of the feed chute clear of gas, steam may be introduced at 92 from any suitable source. A further steam inlet port is indicated at 93, just above the valve member. With the valve closed and by the introduction of steam through inlet port 92, passage of gas upwardly through the chute is prevented for as long as may be desired, thus making it possible for the operator to inspect and repair any portion of the hopper or feed chute above the valve.

As has been before explained, the space between the upper and lower plates of the producer top is for the reception of cooling water, and this water is introduced into the top and withdrawn therefrom by pipes extending along the axis of revolution of the top. Projecting upwardly and detachably secured to the upper plate 13 of the top at the center thereof is a water-tight housing of circular cross-section indicated at 100, the interior of this housing opening at its lower end into the water-cooling space of the producer top and its upper end being provided with an annular flange 101 which makes a revoluble but water-tight fit with the outer surface of the axially

disposed water-outlet pipe 102, the sliding joint between these two relatively rotatable members being suitably packed to prevent water leakage. The water conducting pipe 102 extends upwardly and makes a water-tight joint at its upper end with a manifold 103, opening into the lower chamber 104 of this manifold. The chamber 104 is in communication with the outlet pipe 105 extending radially to a suitable point of disposal for the water discharged after having performed its cooling functions.

A water inlet pipe 106 is disposed parallel to pipe 105 and has communication with the upper chamber 107 of manifold 103. This upper chamber 107 is brought into communication by means of the axially disposed pipe 108 with a series of radiating pipes 109 disposed in the cooling chamber of the producer top, the outer or discharge ends of these pipes 109 being positioned adjacent the periphery of the producer top so that the cooling water is first discharged into the outer portion of the cooling space. At their inner ends the radially disposed water-distributing pipes 109 communicate with the interior of a revoluble manifold 110 mounted upon the lower plate 14 of the producer top, this manifold 110 having an upwardly extending cylindrical flange 111 disposed coaxially of the producer top which makes a water-tight sliding fit with a downturned flange member 112 mounted upon the lower end of the stationary water inlet pipe 108. Suitable packing is provided for preventing leakage of water between relatively revolving members 111 and 112. Pipe 108 is provided with a union 113 and a coupling 114, and the external pipe 102 is formed in two sections provided with mutually engaging flanges 115 detachably connected together. By reason of the fact that the housing 100 is detachably connected to the upper plate 13 and because of the provision of the union 113, coupling 114, and flange connection 115, it is easily possible to disconnect the vertically disposed inlet and outlet pipes from the producer top should this be necessary for cleaning, repacking, or repair.

In order to protect the manifold 103 and the water pipes connected thereto from the downwardly moving fuel, a guard or deflecting tube 116 is provided, this tube being supported centrally of the discharge tube 41 of the hopper, a second guard tube 117 being provided for protecting the laterally extending water inlet and outlet pipes. The outer surface of tube 117 makes a gas-tight joint with the wall of discharge tube 41. A third guard or protecting tube 118 is disposed below and concentrically with guard tube 116, tube 118 passing through the inclined section 43 of the chute and making a gas-tight joint therewith, the joint being preferably welded. Inasmuch as tube 118 revolves with the producer top and tube 116 remains stationary, these tubes are not rigidly secured together but make a gas-tight sliding joint with one another. The joint may be water-sealed or otherwise suitably packed against the escape of gas therethrough, which gas, if it could pass into the interior of tube 118, would make its escape to the atmosphere.

By the means just described it is possible to supply cooling water in desired quantities to the rotating producer top while at the same time supplying fuel to the producer from a hopper located above it, and to an aperture positioned eccentrically in the producer top, without causing gas leakage or interference between the various operating parts.

It will be appreciated that the fuel feeding and water cooling mechanisms illustrated in the drawings and described in detail are one embodiment only of the invention and that, in applying the invention, the design and arrangement of the various component elements may be considerably altered.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. Fuel feeding means for a gas producer comprising a fuel storage hopper having an opening for the introduction of fuel and an opening for the discharge of fuel therefrom, a removable gas-tight closure for the first mentioned opening, a gas-tight chute leading from the last mentioned opening to a producer top, a fuel valve in said chute, means for introducing inert gas or steam under pressure into the hopper to evacuate the producer gas from the hopper and chute prior to the removal of the hopper closure, and means for introducing gas or steam under pressure into the chute below said valve.

2. Fuel feeding means for a gas producer comprising a fuel storage hopper having an opening for the introduction of fuel and an opening for the discharge of fuel therefrom, a removable gas-tight closure for the first mentioned opening, a gas-tight chute leading from the last mentioned opening to a producer top, a valve in said chute, means for introducing inert gas or steam under pressure into the hopper and into the chute above said valve to evacuate the producer gas from the hopper and chute above said valve, and means for introducing inert gas or steam under pressure into said chute below said valve, whereby producer gas is prevented from passing said valve.

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